Pitfalls of Coordination?*

Sergey Slobodyan
National Research University Higher School of Economics, CERGE-EI, and Financial Research Institute of the Ministry of Finance of Russia

I argue that the rather unfavorable conclusions of the three papers in the session on "Coordination and Tradeoffs" might not be as bad as they seem. In particular, I dwell on challenges facing the central bank using an interest rate that is different from the risk-free rate in its Taylor rule, and show that proper redefinition of the intercept and the slope of the rule allows avoidance of inflationary bias and preserves the stability of equilibrium.

JEL Codes: E43, E52, E58, E63.

1. Main Topic of the Session

The session on "Coordination [between monetary and fiscal policies] and Tradeoffs" sends a message that might look rather gloomy at the first view. Coordinating monetary and fiscal policies is hard, especially when the fiscal limit is looming. It was difficult in advanced economies even before the demographic time bomb started ticking and the Great Recession, with its dramatic increase in debt levels across the developed world, struck (Franta, Libich, and Stehlík, this issue). With the higher debt levels, the fiscal limit of monetary policy looms large, but as Bi, Leeper, and Leith (this issue) show, around this limit the contractionary monetary policy is much less effective, while expansionary fiscal policy is much more damaging, leaving little ammunition for stabilization policies. Finally, in a monetary union, the situation could be even worse, as the multiple fiscal authorities, even if they manage to coordinate, are unlikely to converge on an equilibrium that is preferred from the union-wide perspective (Kirsanova, Machado, and Ribeiro, this issue).

*This study was supported by the Czech Science Foundation (GA ČR) project No. 14-29410S.

All three papers of the session are, implicitly or explicitly, calling for more bargaining power in the coordination game between fiscal and monetary authorities to be given to the monetary authority, and for less accommodation of the fiscal policy. For example, in the paper by Bi et al., the central bank (CB) that targets a rate that is risky because of defaults could induce more indeterminacy and fail to hit its inflation target. The CB in this case is essentially accommodating fiscal policy, as the default on bonds is equivalent to the taxation of savings. One obvious solution in this case would be to reject accommodation of the risky rate, which will make the consequences of taxing the savings so dire that the fiscal authority will not do this. In the paper by Kirsanova et al., another look at fiscal/monetary policy interaction, the multiplicity of equilibriums and inability to coordinate on a monetary union-preferred equilibrium calls for institutional arrangements that would allow the union's *monetary* authority to coordinate among national *fiscal* policymakers. Finally, Franta et al. show that, in recent years, the United States and, even more, Japan seem to have moved towards a fiscal dominance regime by accommodating fiscal shocks, thus increasing the probability of future fiscal inflation (debt monetization). They call for more CB independence, supported by expansion of inflation targeting.

2. Overly Gloomy Conclusions?

The conclusions of these papers, however, may be too gloomy. The time-varying parameter vector autoregression (TVP-VAR) error bands in the Franta et al. paper are very wide, and thus the results of the paper are inconclusive at the moment. We also know that in filtering, setting priors that are too tight on the intercept (or on the slope) can change the result quite dramatically (cf. Slobodyan and Wouters 2012, where we investigate the effects of different priors on the adaptive agents' Kalman filtering of the inflation process; decomposition of variability of the inflation process into the time-varying mean and the perceived persistence of inflation could depend significantly on the Kalman filter's priors). A larger role for the intercepts in TVP-VAR might change the interpretation of the results on monetary policy accommodation of the fiscal policy shocks.

Another interesting question that could be related to Franta et al. results is the following. The authors are interested in "strategic monetary-fiscal interactions of the medium- to long-term nature." It is likely that, at such a horizon, government consumption and investment will have a rather different effect, as the government capital is a productive asset, cf. Aschauer (1989). Should the CB react differently to government borrowing to expand the highway system or to build university buildings (presumably, very productive long-run investments) than to government borrowing for expanding transfers? How could we even capture such effects with the VAR framework with a few lags and sign restrictions at the four-quarters horizon, which is probably insufficient for identification of any investment effects? Could we use a news shocks setup (cf. Beaudry and Portier 2006, Barsky and Sims 2011), with expansion of government investment taken as news about future productivity, to get around the problem?

Turning to Kirsanova et al. game-theoretic results on the equilibriums in a monetary-fiscal authority game, we see that they are based on differences in welfare losses of 0.04 percent or less of the steady-state consumption. How politically difficult would it be to set up an institution that prevents opportunistic behavior by the national fiscal authorities, if the maximal imaginable return to opportunism is so small and cooperation is indeed preferable? The solution proposed by Pesenti (this issue) is one example of such an institution.

A more interesting question on the fiscal-monetary game relates to computing the welfare measure. As is common in the literature, Kirsanova et al. assume that the steady-state employment subsidy is paid in both countries, allowing them to avoid linear terms in the second-order approximation to the social welfare function; see footnote 8 of the paper. No linear terms mean that there is no inflation bias in the monetary policy problem. This is a common device, meant to address a well-known observation by Taylor (1983) on the Barro and Gordon (1983) framework:

> In other well-recognized time inconsistency situations, society seems to have found ways to institute the optional (cooperative) policy. For example, patent laws are not repealed each year to prevent holders of patents from creating monopolist inefficiencies. It is obvious that such repeals would eliminate any incentive for future inventions. In the Barro–Gordon inflation–unemployment model, the superiority of the zero inflation policy is just as obvious to people as the well-recognized patent

problem is in the real world. It is therefore difficult to see why the zero inflation policy would not be adopted in such a world.

However, adopting a zero (or low) inflation target might be an obvious solution only to the CB, for which price stability is one of its most important policy objectives. For a fiscal authority, there are many more objectives, including minimizing fluctuations in unemployment, handling redistributional concerns, promoting intergenerational fairness, etc. It makes much less sense to believe that the fiscal authority will at all times strive to maintain low inflation, and accept exclusion of the linear terms from its objective function. Should we therefore return to considering the linear terms in the welfare function for fiscal authorities?

3. The Intercept and the Slope

There are very interesting issues arising from the quasi-fiscal behavior of the CB in Bi et al. paper. The representative household faces the following budget constraint:

$$P_t c_t + \frac{B_t}{R_t} = (1 - \delta_t) B_{t-1} + (1 - \tau_t) (W_t n_t + P_t \Gamma_t) + P_t z_t. \quad (1)$$

One of the sources of income in period t is last period's bonds, which are subject to default. If default happens, $\delta_t > 0$. From the household's point of view, default is the same as a tax on savings. As the government in period t has to repay only $(1 - \delta_t) B_{t-1}$, not B_{t-1}, it is clear that the default has budgetary implications. The decision to default is part of the fiscal policy toolbox.

The possibility of default has implications for the monetary policy as well. In the simplified model of section 3 of the paper, the gross nominal rate on the risky government debt, R_t, satisfies

$$\frac{1}{R_t} = \beta E_t \frac{1 - \delta_{t+1}}{\pi_{t+1}}, \quad (2)$$

while the riskless interest rate R_t^f is governed by

$$\frac{1}{R_t^f} = \beta E_t \frac{1}{\pi_{t+1}}. \quad (3)$$

Obviously, the two interest rates generically have different means as long as $E_t\delta_{t+1} \neq 0$, or the default is possible in principle.

The monetary authority could run policy according to a simplified Taylor rule of the form

$$\frac{1}{R_t^f} = \frac{1}{R^*} + \alpha\left(\frac{1}{\pi_t} - \frac{1}{\pi^*}\right). \tag{4}$$

In this case, it is targeting the risk-free rate. In order for this rule to be valid, the identity (4) above must hold in expectation. If inflation is at its target (and therefore $E\left[1/\pi_t\right] = 1/\pi^*$), then $1/R^* = E\big[1/R_t^f\big] = \beta/\pi^*$ and in expectation we obtain $0 = 0$.

The CB also could target the interest rate on government bonds, R_t, in which case

$$\frac{1}{R_t} = \frac{1}{R^*} + \alpha\left(\frac{1}{\pi_t} - \frac{1}{\pi^*}\right). \tag{5}$$

It is clear from the discussion in section 3 of the paper that R^* is the same as R^* in (4), and therefore $1/R^* = \beta/\pi^*$. Suppose that $\delta_t \equiv \delta > 0$. As is easy to notice, in this case the rule (5) is a mistake, assuming that the CB maintains the same inflation target, because

$$E\left[\frac{1}{R_t} - \frac{1}{R^*}\right] = E\left[\frac{1-\delta}{R_t^f} - \frac{1}{R^*}\right] \neq E\left[\alpha\left(\frac{1}{\pi_t} - \frac{1}{\pi^*}\right)\right] = 0,$$

as long as $E\left[1/\pi_t\right] = 1/\pi^*$ and therefore $E\big[1/R_t^f\big] = 1/R^* = \beta/\pi^*$. The two sides of this Taylor rule could *only* be equilibrated on average if $E\left[1/\pi_t\right] < 1/\pi^*$ and thus there is an inflationary bias. It is also obvious that if the CB recognized its mistake and used the average *risky* rate (let me call it $R^{\delta *}$) as an intercept in the policy rule, there will be no inflationary bias:

$$E\left[\frac{1}{R_t} - \frac{1}{R^{\delta *}}\right] = E\left[\frac{1-\delta}{R_t^f} - \frac{1-\delta}{R^*}\right] = E\left[\alpha\left(\frac{1}{\pi_t} - \frac{1}{\pi^*}\right)\right],$$

because when inflation is at its target and $E\left[1/\pi_t\right] = 1/\pi^*$, equation (3) implies that $E\big[1/R_t^f\big] = 1/R^*$. The first equality in the above formula follows from equation (2).

The situation with the CB using an incorrect intercept is reminiscent of the recent debate about r^*, cf. Summers (2014), Yellen (2015, 2017), Clarida (2017), Holston, Kaubach, and Williams (2017), and the opposing view in Beyer and Wieland (2017). As the sensitivity analysis of Beyer and Wieland (2017) clearly demonstrates, recognizing in real time that the r^* has changed and therefore adjustments to the intercept of the Taylor rule are necessary is a very difficult proposition, indeed, and therefore the CB could be using the wrong intercept for a long time.

However, studies of historical monetary policy make it clear that, in the past, at least the Federal Reserve was aware of the time-varying intercept and was adjusting its behavior accordingly. For example, Nikolsko-Rzhevskyy, Papell, and Prodan (2014) estimate Taylor rules for four different monetary policy eras between 1965 and 2013 in the United States, showing widely divergent intercepts in these periods. Mehra and Sawhney (2010) estimate the Taylor rule of the Greenspan and Bernanke periods, showing that the best fit is for a policy rule that switches from using the core CPI to the core personal consumption expenditure (PCE) deflator around 2000. It yields stable estimates with reasonable inflation and unemployment gap response coefficients, in contrast to rules that use headline or core CPI throughout, which deliver non-sensical and/or unstable estimates. As the CPI was, on average, higher than the core PCE during the 2000s, one could consider this as proof that the Federal Reserve recognized that the constant changed and adjusted the intercept of its Taylor rule accordingly. In earlier work, Fuhrer (1996) demonstrated that the pure expectations hypothesis explains the yield curve of U.S. government bonds during 1966–94 to a much better degree if one assumes time variation in both the slope and the intercept of the Taylor rule.

Thus, while the CB effectively accommodating fiscal policy by targeting a risky interest rate could lead to inflation bias, emergence of the bias is not a foregone conclusion. The CB could recognize that the intercept of the Taylor rule should be adjusted, and this may have happened in the past.

What about the stability (determinacy) results? Appendix 1 of Bi et al. paper shows that as the steady-state inflation increases with the default rate δ, the necessary conditions for determinacy may fail to hold. As the previous discussion has shown, inflationary bias could be removed if the CB recognizes that the interest rate it targets, R_t, is higher on average than R_t^f, and adjusts the intercept of the Taylor rule accordingly. However, there is another, more subtle effect related to (in)determinacy, when targeting R_t.

Consider again the policy rule (5) with the corrected intercept and a slope $\tilde{\alpha}$:

$$\frac{1}{R_t} = \frac{1}{R^{\delta *}} + \tilde{\alpha}\left(\frac{1}{\pi_t} - \frac{1}{\pi^*}\right). \tag{6}$$

Assuming again that $\delta_t \equiv \delta$, we could write it as

$$\frac{1-\delta}{R_t^f} = \frac{1-\delta}{R^*} + \tilde{\alpha}\left(\frac{1}{\pi_t} - \frac{1}{\pi^*}\right), \tag{7a}$$

$$\frac{1}{R_t^f} = \frac{1}{R^*} + \frac{\tilde{\alpha}}{1-\delta}\left(\frac{1}{\pi_t} - \frac{1}{\pi^*}\right). \tag{7b}$$

In other words, the rule that targets risky rate R_t is *completely* equivalent to the rule targeting risk-free rate (4), if both the slope and the intercept of the Taylor rule are correctly adjusted: The CB must use $1/R^{\delta *}$ as an intercept and $\tilde{\alpha} = \alpha \cdot (1-\delta)$ as the slope. As (7b) and (4) are, in fact, the *same* rule, they must deliver the same (in)determinacy outcome. Thus, the CB which recognizes that the *scale* of the variable it targets has changed must adjust the policy rule coefficients accordingly to achieve the same stability results as before. One cannot treat "1.5 for inflation, 0.5 for output gap" as universal constants. The numbers will change if there are multiplicative shifters in the targeted variable.

The issue of scaling is reminiscent of a similar problem in the adaptive learning literature—the scaling invariance of learning algorithms; see Evans, Honkapohja, and Williams (2010). In a standard recursive least-squares learning algorithm, the agents adjust their beliefs ϕ_t as

$$\phi_t = \phi_{t-1} + t^{-1} R_t^{-1} z_{t-1}\left(p_t - \phi_{t-1}^T z_{t-1}\right), \tag{8}$$

where p_t is the observable outcome variable, z_t are the variables the agents use for forecasting the price in the next period, and R_t is the matrix of the second moments of the data (z). If the data are scaled by a certain factor, say β, its "typical size," captured by variances and covariances in R_t, changes by β^2. Then, if one scales ϕ by a factor of $\frac{1}{\beta}$, it is easy to see that the equation (8) remains invariant to the scaling and delivers the same forecasts $\left\{\phi_{t-1}^{T} z_{t-1}\right\}_{t=1}^{\infty}$. Therefore, the agents' actions remain the same. This invariance result is not true if the agents are using the so-called stochastic gradient learning algorithm, where

$$\phi_t = \phi_{t-1} + t^{-1} z_{t-1} \left(p_t - \phi_{t-1}^{T} z_{t-1} \right).$$

Here, scaling of the data by β cannot be compensated for, and the resulting beliefs adjustment process is now different.

Similarly to the case of monetary policy, one could rescale the coefficients of the fiscal rule. The fiscal rule (21) in the paper in the presence of defaults is given by

$$s_t - s^* = \gamma \left((1 - \delta_t) \frac{B_{t-1}}{P_{t-1}} - b^* \right). \tag{9}$$

This leads to equation (23),

$$\gamma > \frac{\beta^{-1} - 1}{1 - E_t \delta_{t+1}},$$

as the condition for stability of the debt process, which is more stringent than the usual $\gamma > \beta^{-1} - 1$ rule. However, if the government targets not the real value of the debt promised to be repaid, b^*, but the actual debt repaid on average, $(1 - E_t \delta_{t+1})\, b^*$, and uses the fiscal rule

$$s_t - s^* = \tilde{\gamma} \left(\frac{B_{t-1}}{P_{t-1}} - b^* \right),$$

with $\tilde{\gamma} = \gamma\,(1 - \delta)$, we have exactly the same rule as in the case of zero default (up to a small error term), and thus the same debt stability condition.

4. Conclusion

This commentary has argued that the somewhat pessimistic results of the papers presented in the section "Coordination and Tradeoffs" might be cast in a brighter light. In particular, the central bank of Bi et al. (this issue) might recognize that it is targeting an interest rate that differs from the risk-free rate by a multiplicative (possibly stochastic) scaling factor. If the CB adjusts both the intercept and the slope of its Taylor rule, there are no negative consequences in terms of inflationary bias or a larger region of indeterminacy. Similarly, the government could adjust both the target level of the debt and the coefficient measuring the sensitivity of the desired surplus to the debt's deviations from the target, leaving the stability conditions of the debt process the same as in the case of no default. The key to avoiding (some) negative consequences of possible defaults is to recognize the scaling issue and take it into account in the policy rules.

References

Aschauer, D. A. 1989. "Is Public Expenditure Productive?" *Journal of Monetary Economics* 23 (2): 177–200.

Barro, R. J., and D. B. Gordon. 1983. "A Positive Theory of Monetary Policy in a Natural Rate Model." *Journal of Political Economy* 91 (4): 589–610.

Barsky, R., and E. Sims. 2011. "News Shocks and Business Cycles." *Journal of Monetary Economics* 58 (3): 273–89.

Beaudry, P., and F. Portier. 2006. "Stock Prices, News and Economic Fluctuations." *American Economic Review* 96 (4): 1293–1307.

Beyer, R. C. M., and V. Wieland. 2017. "Instability, Imprecision and Inconsistent Use of Equilibrium Real Interest Rate Estimates." Working Paper No. 110, Institute for Monetary and Financial Stability, Goethe University Frankfurt.

Clarida, R. H. 2017. "The Global Factor in Neutral Policy Rates: Some Implications for Exchange Rates, Monetary Policy, and Policy Coordination." NBER Working Paper No. 23562.

Evans, G. W., S. Honkapohja, and N. Williams. 2010. "Generalized Stochastic Gradient Learning." *International Economic Review* 51 (1): 237–62.

Fuhrer, J. C. 1996. "Monetary Policy Shifts and Long-Term Interest Rates." *Quarterly Journal of Economics* 111 (4): 1183–1209.

Holston, K., T. Laubach, and J. C. Williams. 2017. "Measuring the Natural Rate of Interest: International Trends and

Determinants." *Journal of International Economics* 108 (Supplement 1): 559–75.

Mehra, Y. P., and B. Sawhney. 2010. "Inflation Measure, Taylor Rules, and the Greenspan-Bernanke Years." *Economic Quarterly* (Federal Reserve Bank of Richmond) 96 (2, Second Quarter): 123–51.

Nikolsko-Rzhevsky, A., D. H. Papell, and R. Prodan. 2014. "The Taylor Principles." Mimeo.

Slobodyan, S., and R. Wouters. 2012. "Learning in a Medium-Scale DSGE Model with Expectations Based on Small Forecasting Models." *American Economic Journal: Macroeconomics* 4 (2): 65–101.

Summers, L. 2014. "U.S. Economic Prospects: Secular Stagnation, Hysteresis, and the Zero Lower Bound." *Business Economics* 49 (2): 65–73.

Taylor, J. B. 1983. "Comments: 'Rules, Discretion and Reputation in a Model of Monetary Policy'." *Journal of Monetary Economics* 12 (1): 123–25.

Yellen, J. 2015. "Normalizing Monetary Policy: Prospects and Perspectives." Speech at "The New Normal Monetary Policy" research conference sponsored by the Federal Reserve Bank of San Francisco, San Francisco, California, March 27.

———. 2017. "The Economic Outlook and the Conduct of Monetary Policy." Speech at the Stanford Institute for Economic Policy Research, Stanford University, Stanford, California, January 19.